OPERATION DEEP FREEZE

Airmen aid research in thawing secrets of the universe

by Master Sgt. Chuck Roberts
photos by Master Sgt. Efrain Gonzalez

When the IceCube Neutrino Detector one day tracks down the origin of the universe, Maj. Kurt Bedore won't be mentioned among the discoverer's of one of the longest-standing quests in modern astrophysics. But the Air Force navigator could honestly claim researchers wouldn't have gotten there without him — literally and figuratively.

After a C-141 Starlifter lands on a compacted snow runway at McMurdo Station in Antarctica, *Tech. Sgt. Bob Miller waits for loading to be completed before refueling the aircraft for its return trip to Christchurch, New Zealand. The reservist, a flight control specialist with the 452nd Maintenance Squadron at March Air Reserve Base, Calif., was in Antarctica as part of the Operation Deep Freeze mission to support the U.S. Antarctic Program.*

IceCube is an underground observatory being constructed at the South Pole. When completed, it will measure and chart the path of neutrinos, the smallest particles of matter, as they travel from space through Earth.

The $272 million project will take about six years to bury more than 4,800 sensors in 80 holes more than a mile deep into the highest, driest, coldest and windiest continent. It requires the world's heaviest ice drill.

And every man, machine and piece of equipment needed to construct IceCube is delivered to the South Pole by Air Force LC-130 "Ski Herks." Almost daily during the austral summer season of October through February, these ski planes glide to a stop on the South Pole's snow-packed runway. They are unloaded only a short walk from a shiny balled marker denoting where Norwegian explorer Roald Amundsen became the first to reach the geographic South Pole on Dec. 14, 1911. Within 45 years, however, the Amundsen-Scott South Pole Station was erected by the Navy, making it the southernmost continually inhabited dwelling on Earth — and a hotbed for science.

A tracked fire truck stands by after a C-141 Starlifter lands in Antarctica *to provide vital food and supplies to the approximately 1,000 people who live at McMurdo Station during the austral summer when temperatures usually peak only in the 30s.*

Gotta be Herkable

"World class science is done here, and you folks [Airmen] bring it to us," said South Pole Station Manager Jerry Marty, watching more than 40,000 pounds of fuel being downloaded from the Ski Herk into holding tanks used to fuel the station. Herk 95, as the mission was named, had just arrived from McMurdo Station, Antarctica. Flying it was Major Bedore and fellow Air National Guardsmen from the 109th Airlift Wing out of Stratton Air National Guard Base in Scotia, N.Y.

"This whole station is possible because of the Air Force," Mr. Marty said of IceCube and the mammoth new living and research center, also under construction. The center had more than 900 LC-130 missions delivering approximately 28 million pounds of materiel. Although the project is mammoth in size, parts and machinery, everything "has to be Herkable," Mr. Marty said.

Moments later, as the drone of the next Ski Herk could be heard approaching through the crisp minus 20-degree air, Mr. Marty gazed upward. "That's beautiful, I love those planes."

This mix of science and military has been underway since 1959 when the U.S. Antarctic Program was established to support the Antarctic Treaty, foster cooperative research with other nations and protect the environment. The challenge became how to support a mission when the logistical hub — Christchurch, New Zealand — is 2,415 miles from the main Antarctic research site. And McMurdo Station, the support hub for 15 other remote sites, including the Amundsen-Scott South Pole Station, is 837 miles from McMurdo.

Added to the challenge of long distances is the short timeframe allowed by the elements to do the job. Thousands of scientists and support people and millions of pounds of supplies must be moved during the short Antarctic summer. With the end of summer comes the transition from eternal sunshine to eternal darkness, combined with lows dipping to minus 50 degrees.

The answer to this logistical tightrope is Operation Deep Freeze. It involves about 600 U.S. servicemembers operating Coast Guard helicopters and ice cutters, Navy tanker ships, Air Force Ski Herks, C-141 Starlifters, C-5 Galaxies and C-17 Globemasters. Of the approximately 150 Airmen, about 70 percent are Guardsmen from the 109th. This year, about 20 percent came from March Air Reserve Base, Calif., and the remainder from various bases. Deployments range from about 14 to 45 days or more. The bulk of the force is based in Antarctica, but positions such as manpower and security forces remain in Christchurch.

"We are the gateway to Antarctica," Col. Tye Beasley said of the servicemembers he led during the most recent season. Keeping the gateway open and accessible requires a lot of hard work and logistics, the Support Forces Antarctica commander said. But Deep Freeze participants return home "with a great sense of pride and accomplishment" for their role in helping "rewrite the textbooks of tomorrow."

For example, it was at McMurdo Station in 1986 where researchers linked chlorofluorocarbons as the probable cause of the Antarctic ozone hole. And deep-dwelling cod fish in nearby McMurdo Sound should freeze in their extreme habitat, but they don't because of a type of antifreeze in their bodies. The answer to how the cod do this could lead to practical applications such as preventing crops from freezing.

Military meets science

The combination of science and servicemembers is "a bit different," said Brian Stone, the Antarctica representative for the National Science Foundation that funds and manages the U.S. Antarctica Program. "But it works, and it works really well."

There are three phases to Operation Deep Freeze. The operation gets underway each August when cargo planes brave the end-of-winter weather during the first phase of Deep Freeze, known as Winter Fly, or "Winfly." The arrival of C-141s, C-5s and C-17s mark the first contact with the outside world since February for the approximately 160 people who've wintered over at McMurdo Station. At its peak, McMurdo, or "Mac Town" as it's commonly referred to, will often peak at more than 1,000 summer inhabitants.

"Winfly is a popular trip," said Maj. Gevin Harrison, this season's strategic airlift commander. He said the arrival is a welcomed sight for people who haven't tasted fresh fruits or vegetables, or "freshies" at McMurdo.

But the five-hour trip from Christchurch can also be packed with drama as crews must contend with only two hours of daylight and wind chills of more than 100 below zero.

"I haven't been anywhere where it's more volatile," said Major Gevin, who has landed Air Force aircraft on all seven continents. It's hundreds of thousands of miles of whiteness," he said. Add a little unexpected wind and snow and suddenly the horizon can disappear. "That's when you get into a treacherous situation. It's like looking into a white sheet of paper or being inside a ping-pong ball."

No turning back

But when pilots pass the point of safe return, there's no turning back regardless of how severe conditions may become, Major Harrison said. At the four-hour point of the trip to McMurdo, pilot and crew must consider all factors — weather, fuel and runway conditions. At this point they decide to push on or "boomerang" — turn and go home. One look at the side of a C-141 tells how successful the aircraft has been in reaching the "ice." A penguin painted on the side denotes a successful mission and a boomerang — one that didn't make it.

Maj. John Panoski, left, and Maj. Kathy McNully gaze upon an endless sea of ice *while flying their LC-130 ski plane from Antarctica to New Zealand. The two pilots deployed from the 109th Airlift Wing in Scotia, N.Y., to support Operation Deep Freeze.*

Once on the ground, engines are shut down to prevent heat and soot damage to the snow-compacted frozen runway groomed by Raytheon employees on the Ross Ice Shelf. When aging C-141s fly there, every effort is made to coax them into starting again a few hours later for departure back to Christchurch. Heaters are strategically placed in areas such as wheel wells to keep grease, pins and other parts from freezing. If a plane breaks on the ice, it must remain until parts can be flown from Christchurch.

"Being able to get an aircraft into Antarctica safe and the people back home safe again — A-1 [without discrepancies] — that's one of the best feelings," said Master Sgt. Hugo Castanedas, a maintainer from March who is assisting with the mission's transition to the C-17. This marked the last year C-141s will support Deep Freeze. The aircraft has the distinction of being the first jet to land on Antarctica Nov. 14, 1966.

The next phase of the operation — "main body" — is when the continent emerges from hibernation and the pulse quickens. After returning home in time for Thanksgiving, at the conclusion of Winfly, the C-141s return for the main body phase that lasts from about September through November.

The Operation Deep Freeze season winds down from

Scientists, firefighters, Airmen and others stand by *bundled and ready to board a C-141 Starlifter ferrying them from Christchurch, New Zealand, to McMurdo Station where they'll reside during the Antarctic summer.*

December through February with the redeployment phase, usually consisting of about 25 missions to slowly depopulate McMurdo and at the same time, begin stockpiling winter supplies.

Ice bound

But at 5 a.m. on a Tuesday in February, operations still looked in full swing. A group of 94 scientists, firefighters, Coast Guardsmen and others who had gathered at the Antarctic Program passenger terminal in Christchurch resembled a group of heavily bundled skiers waiting for a bus to the slopes. A New Zealand air force sergeant quiets the group for its briefing before heading to the ice.

"You'll remember the next 48 hours the rest of your life," he told the first-timers. He also passed along some serious advice that "shortcuts or curiosity can kill you" in Antarctica.

Five hours later, the mass of over-dressed human cargo lumbered out of the Starlifter and climbed into a tracked vehicle that resembled a contraption from a Star Wars movie. Outside the foggy "bus" windows, a plume from Mount Erebus was a silent reminder of the fury within the active volcano. A long, slow, sweaty drive ended at McMurdo Station where its assemblage of more than 80 rustic buildings looked down on frozen McMurdo Sound. A Coast Guard ice breaker sat still in the frozen waters while awaiting repairs to continue its mission of breaking a pathway for two tankers carrying a winter's worth of heating oil and supplies.

During main body, both Ski Herks and Starlifters operate on an ice runway that allows them to use wheels for takeoff and landing on a bed of sea ice within a few miles of McMurdo Station. Major Harrison described it as having the feel of a wet runway. But toward the end of December, it can literally turn wet when the sea ice begins melting. This signals the time for Ski Herks to use their skis on the packed snow runway at Willy Field, while Starlifters use the more hard-packed Pegasus runway again.

Ski Herk aircrews fly as many as eight missions a day, six days a week from Mac Town to the South Pole and to remote field sites consisting of little more than tents.

Battling Mother Nature

It's summertime, but it's also Antarctica, where average summertime temps are only in the 30s, and where the world's lowest temperature was recorded at minus 128 degrees.

"The extreme cold — that's where our battle is," said Master Sgt. Lance Peck, an LC-130 loadmaster. "Flying in Antarctica is the closest you can get to combat without bullets flying at you." Instead, he described the battle against a wind chill of minus 135 degrees, when nostrils freeze and moisture freezes eyes shut, leaving aircrews with what they call "the Popeye look."

But what he sees from above still makes the job fun after 15 trips to the ice. Air Force LC-130s used to assist Navy ski planes, but the 109th took over the mission in 1998. The stunning beauty of the Transantarctic Mountains from a cockpit window where aircrews have the privilege of observing seals, penguins and killer whales never wears thin, said Sergeant Peck.

"We do stuff here you read about in National Geographic, but to see it is incredible," said fellow loadmaster Senior Master Sgt. Larry Lisowski. "It's the greatest part-time job you've ever seen."

For Capt. Bill Carraher, it's what he doesn't see that makes the job dicey for the Ski Herk pilot. Even before getting airborne, he said the Antarctic can play tricks on the senses as maintainers appear to float past his cockpit window in foggy weather. With the extra drag created by the three skis, takeoff is performed at an airspeed he describes as somewhere between a stall and normal takeoff speed.

Landing can also be an adventure when sudden weather changes blend the whiteness of the sky and horizon, or "Zero-Zero" as crewmembers refer to zero visibility, zero ceiling. "There's nothing for your eyeballs to grab hold of," he said. "You don't know what's up or down."

In extreme cases, pilots perform a whiteout landing with the help of the entire crew acting as an extra set of eyes.

"You pick a descent profile and follow it to the ground," Capt. Carraher said. At the same time, he keys in on the voice of his flight engineer counting off the distance from the ground — "30 feet, 20 feet," — and then putting the aircraft on the ground.

Big and slow is how the traffic usually flows in Antarctica. *Two trucks laden with cargo downloaded from a C-141 Starlifter plod across frozen ice while traveling from the Pegasus frozen runway to McMurdo Station, where Airmen live alongside scientists at the bottom of the world.*

At the Albert P. Crary Science and Engineering Center, *Airmen can view sea life rarely seen outside of their natural habitats. Steve Alexander, supervisor of laboratory operations, displays a transparent Antarctic cod fish during a tour of the center.*

Then it belongs to maintainers such as Master Sgt. Mark Piehler, a line chief who spends most of his 12-hour shift outdoors. With up to an hour required to get to and from work, he described a day on the ice as "very tiring" and "draining."

The aircraft experience a similar effect — fuel gels up, hydraulic fluid, oils and lubricants thicken, electrical wiring gets brittle, seals leak and windows crack from the extreme cold.

"It affects just about everything on the airplane," said Master Sgt. Dan Smith, a maintenance supervisor who oversees 23 maintainers on the day shift. But unlike maintainers who need that one day off each week to recharge their batteries, the Ski Herk performs best if kept busy.

"If we keep them flying, they're OK. If they're not, it's a domino effect," he said.

Keeping them flying is what Major Bedore does. The navigator keeps the Deep Freeze mission on course despite flying into one of the few places on earth where even a basic hand-held magnetic compass can become confused. A day at work can easily extend to days. He's shared the same fate as other aircrew members who've been forced to hole up at a remote site two to three days after being forced to land because of nasty weather.

"We always have to be on our toes. There's always a curveball on every mission," Major Bedore said at about 21,000 feet while enroute to the South Pole. But like others, he said Operation Deep Freeze is the place to be.

"There's a lot of satisfaction. I know I'm helping out with a humanitarian cause and advancing humanity. The common man benefits from this."